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Quarterly Report – Public Page

For Period Ending: December 27, 2010

Contract Number: DTPH56-09-T-000003

Prepared for: United States Department of Transportation
Pipeline and Hazardous Materials Safety Administration
Office of Pipeline Safety

Project Title: “Determine New Design and Construction Techniques for Transportation of Ethanol and Ethanol/Gasoline Blends in New Pipelines, #394”

Prepared by: Mr. Mark Yunovich
Principal Investigator
Honeywell International Inc.
11201 Greens Crossing Blvd., Ste 700
Houston, TX 77067
Mark.Yunovich@Honeywell.com

Ian Wood
Team Project Manager
Electricore, Inc.
27943 Smyth Drive, Suite 105
Valencia, CA 91355
ian@electricore.org



Background

This project address ethanol gaps identified at The Safe & Reliable Ethanol Transportation & Storage Technical Road Mapping Workshop held in Dublin, Ohio in October 2007. Several key areas are addressed which directly support the PHMSA mission for public safety, including: Safety of Transporting Blends Containing More than 10 Percent Ethanol (Requirements for pipelines to handle FGE – E95); Phenomenological Understanding of Ethanol SCC (Understanding and Use of metallurgical, welding and surface treatments to mitigate SCC). The project will improve pipeline safety by supplying key information necessary to address gaps in industry and regulatory knowledge for the design and construction of ethanol and ethanol/gasoline blend pipelines.

The objectives of the project are:

1. Develop supporting data, related analysis and recommendations for cost-effective design and construction methods for reducing the effects of eSCC that can be implemented in new pipeline systems to allow safe and efficient transportation of Fuel Grade Ethanol (FGE).
2. Evaluate design aspects for control and monitoring of oxygen uptake and internal corrosion for pipelines transporting FGE
3. Recommend the most advantageous direction for expanded and improved pipeline design and testing standards for operations involving exposure to FGE

Progress in the Quarter

Colonial Pipeline has found the final exotic pipe, B8, and has begun the procurement process. They should know the delivery schedule early next year.

Honeywell has completed the metallurgical evaluation of the following pipes received from EWI.

- Final Type A2 steel (Durabond pipe #A6053, UOE X70, 0.686 in. wall thickness)
- B2 steel (Europipe pipe #118433 (X60, 30 in. diameter, 0.688 in. wall thickness),
- B3 steel (Welspun pipe #K10026926 (X70, 42 in. diameter, 0.541 in. wall thickness)
- B5 steel (Durabond pipe #C6068, UO–non-expanded X70. 0.500 in. wall thickness)

Metallographic analysis revealed that the microstructure on steel A2 corresponded to tempered martensite. For steel B2, the microstructure corresponded to ferrite and pearlite. For steels B3 and B5, the microstructures were consistent with acicular ferrite likely with some carbides.

Honeywell has completed the N-SSR testing on steel A2 in air and SFGE environments, as part of the remaining scope of work allocated in Task 1.1 of the project. They further analyzed the tested specimens by SEM to characterize their fracture morphology. An evaluation of the N-SSR testing results and the SEM micrographs revealed predominantly transgranular SCC on specimens tested in the environment. The average crack growth rates CGR for eSCC was calculated at 6.10×10^{-6} mm/sec. Furthermore, the results from the fracture analyses indicated that K_{ISCC} (threshold stress intensity required for ethanol stress corrosion cracking) was around 52 ksi (in.)^{1/2} with a baseline air fracture toughness value of 97 ksi (in.)^{1/2}.

The project team conducted a detailed analysis of results from N-SSR testing on type A materials and it was determined that steel A2 had the lowest resistance to ethanol SCC (eSCC). After discussions with EWI representatives, the project team decided to utilize steel A3 for Task 1.2 (Effects of Welding and Residual Stress) and Task 1.3 (Evaluation of Surface Treatment Effects).

Honeywell completed machining of smooth SSR specimens from Steel A3 required for Task 1.3 (Evaluation of Surface Treatment Effects) and the samples have been provided to EWI for further treatment by shot peening.

Honeywell is continuing to procure the probes for dissolved oxygen monitoring and internal corrosion monitoring. (Task 2.1 and 2.2). Specimens required for conducting internal corrosion measurements in ethanol are also being procured.

Issues, Problems or Challenges

There are no problems to report to date. The team will continue reporting on the delivery of the final exotic pipe.

Plans for Future Activity

Over the next quarterly reporting period the following activities will be undertaken:

- Honeywell will conduct metallurgical evaluation of any other steels received in the next quarter along with machining of test specimens for corrosion testing.
- Honeywell will conduct SSR testing on the available steels.
- Completion of procurement of probes for dissolved oxygen monitoring and internal corrosion monitoring and initiation of testing (Task 2.1 and 2.2-Laboratory demonstration).